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Gurney et al.

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(54) **POWER OUTLET WITH RETENTION AND SHOCK PROTECTION**

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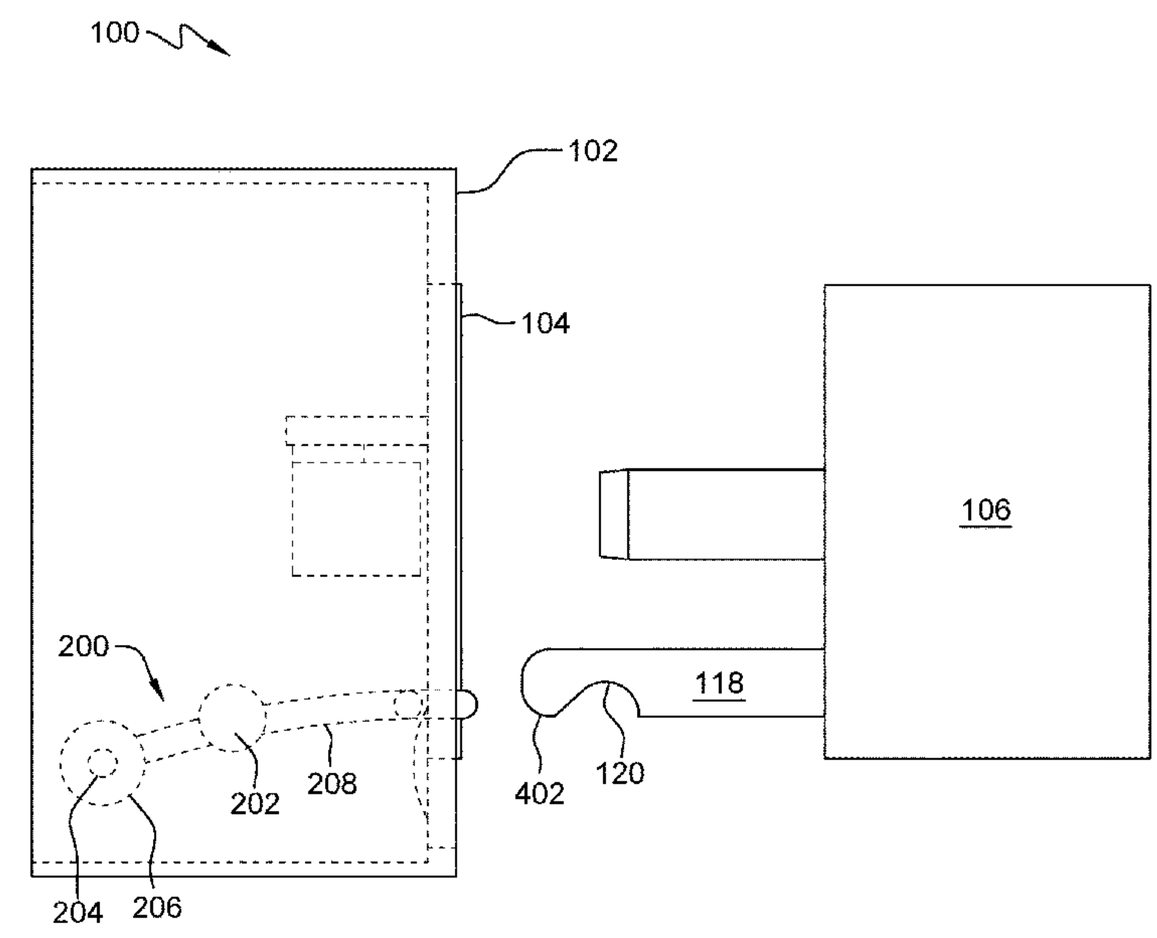
Primary Examiner — Neil Abrams
(74) *Attorney, Agent, or Firm* — Tihon Poltavets

(57) **ABSTRACT**

An apparatus includes an electrical plug insertable into a power outlet of a receptacle, where the electrical plug includes a ground pin with an indent. The apparatus further includes a retention mechanism enclosed by the receptacle includes a rod configured to interact with the indent of the ground pin, where the rod seated within the indent of the ground pin prevents a removal of the electrical plug from the power outlet.

19 Claims, 7 Drawing Sheets



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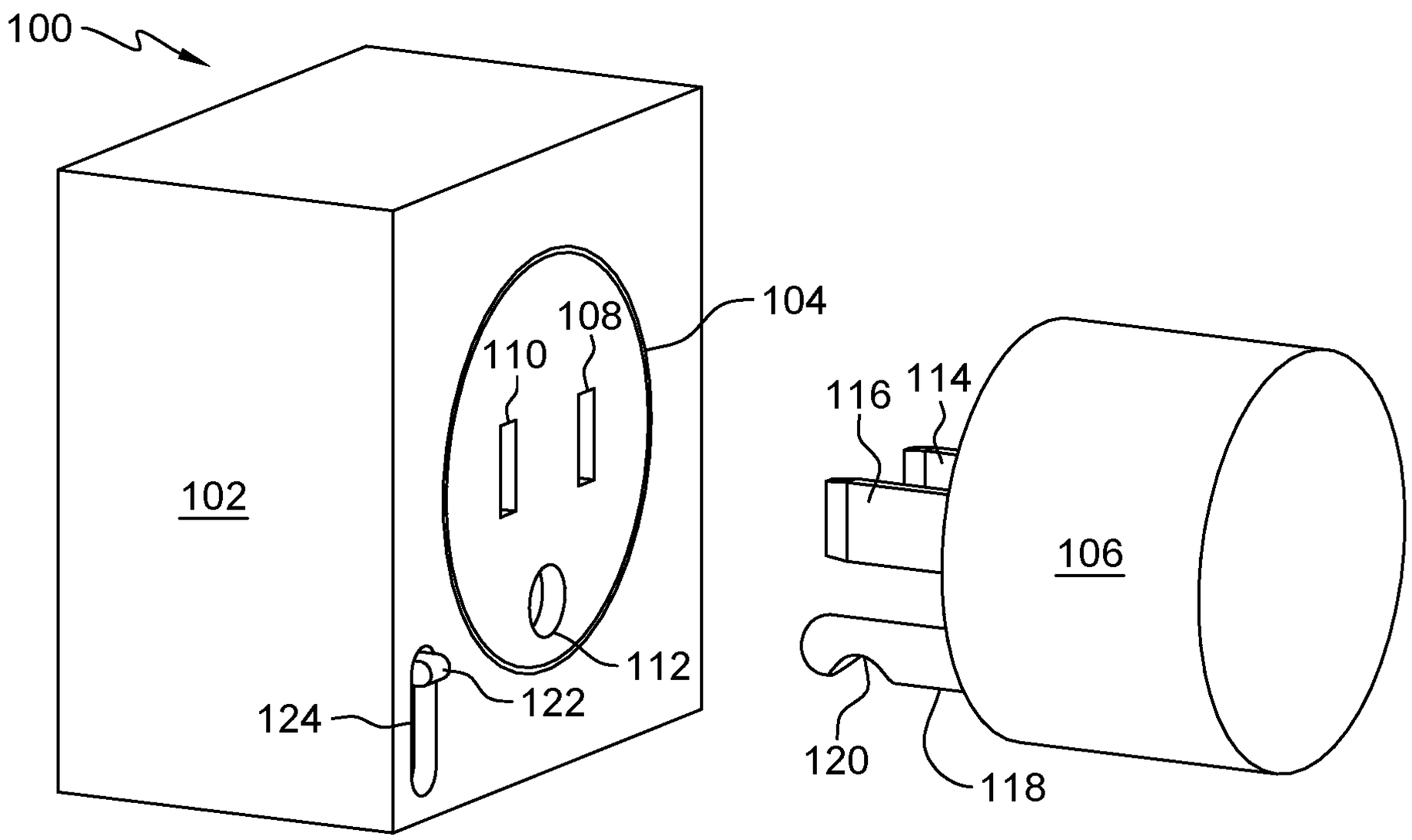
100
102
104
108
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112
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114
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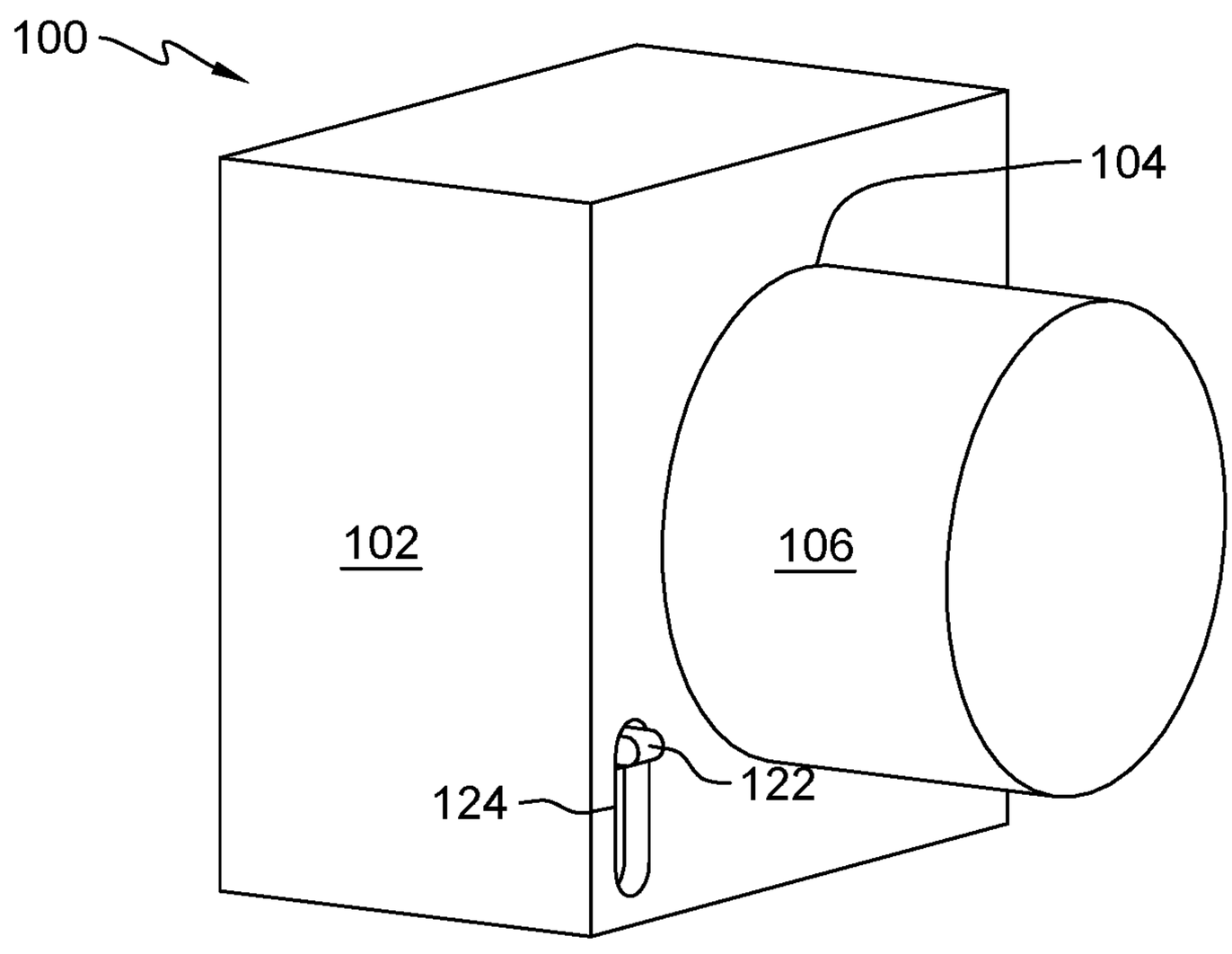
120
118

FIG. 1A


100
102
104
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122
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FIG. 1B

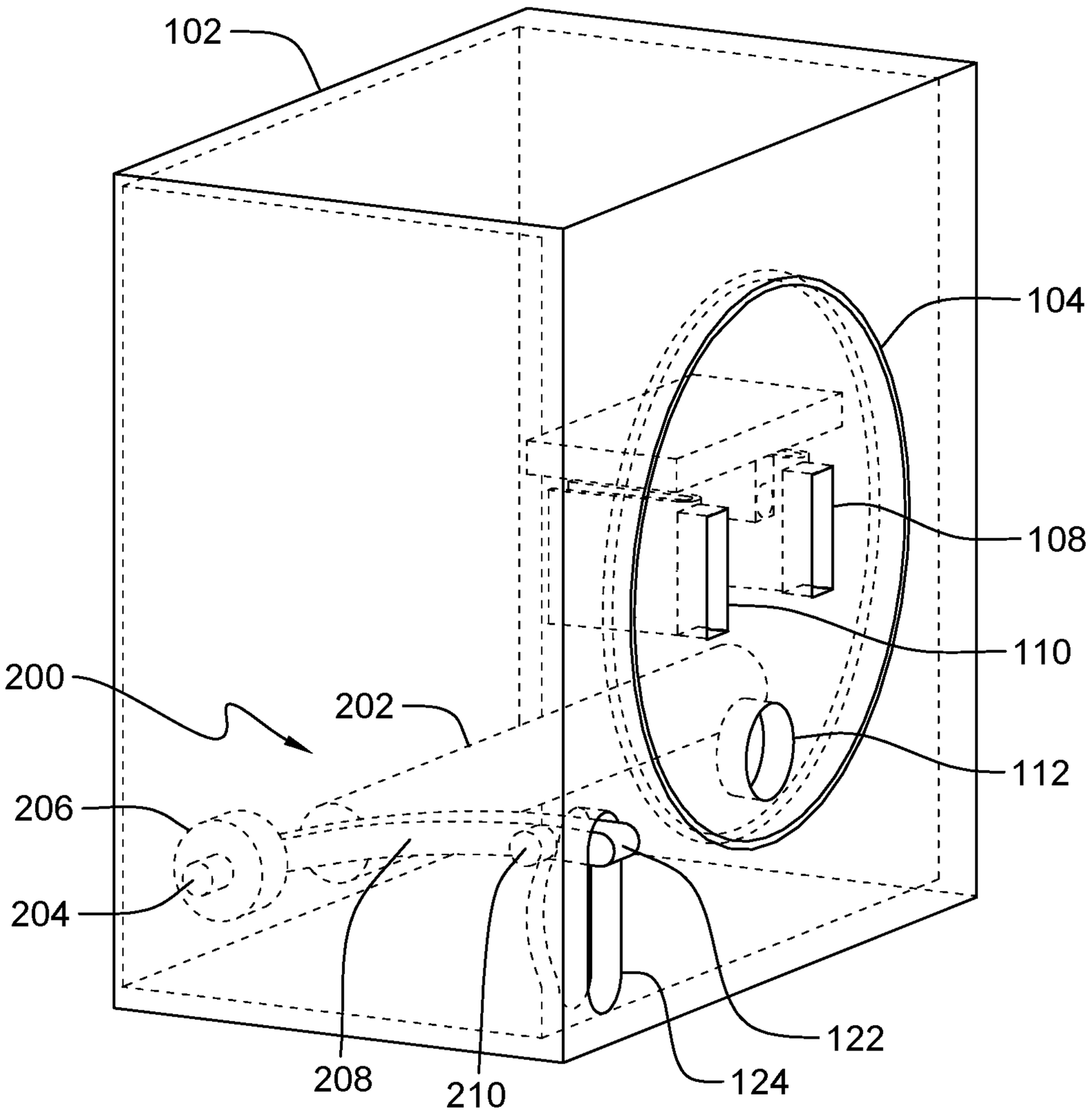

FIG. 2

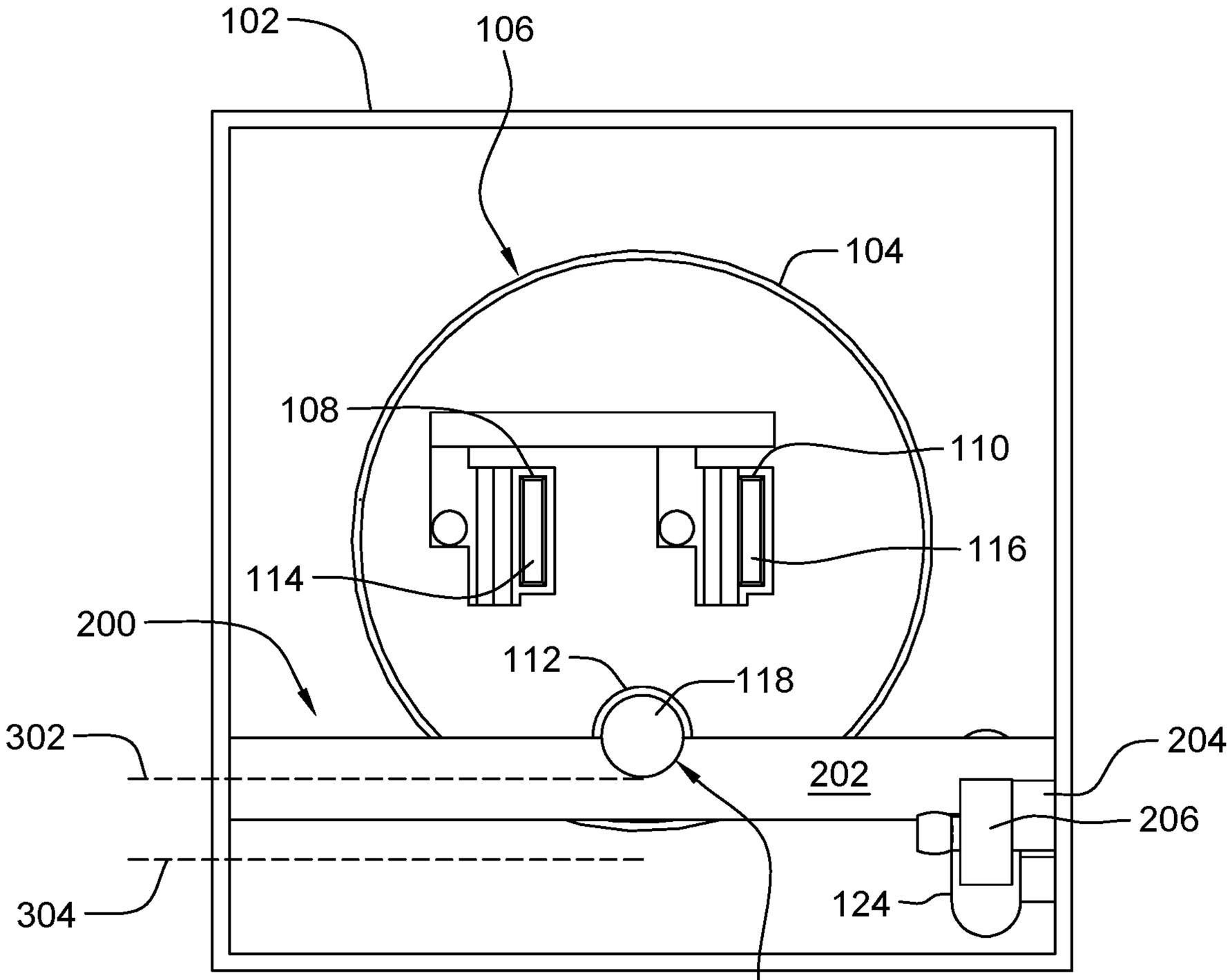
102
106
104
108
110
116
114
200
112
118
302
202
204
206
304
124
120

FIG. 3A

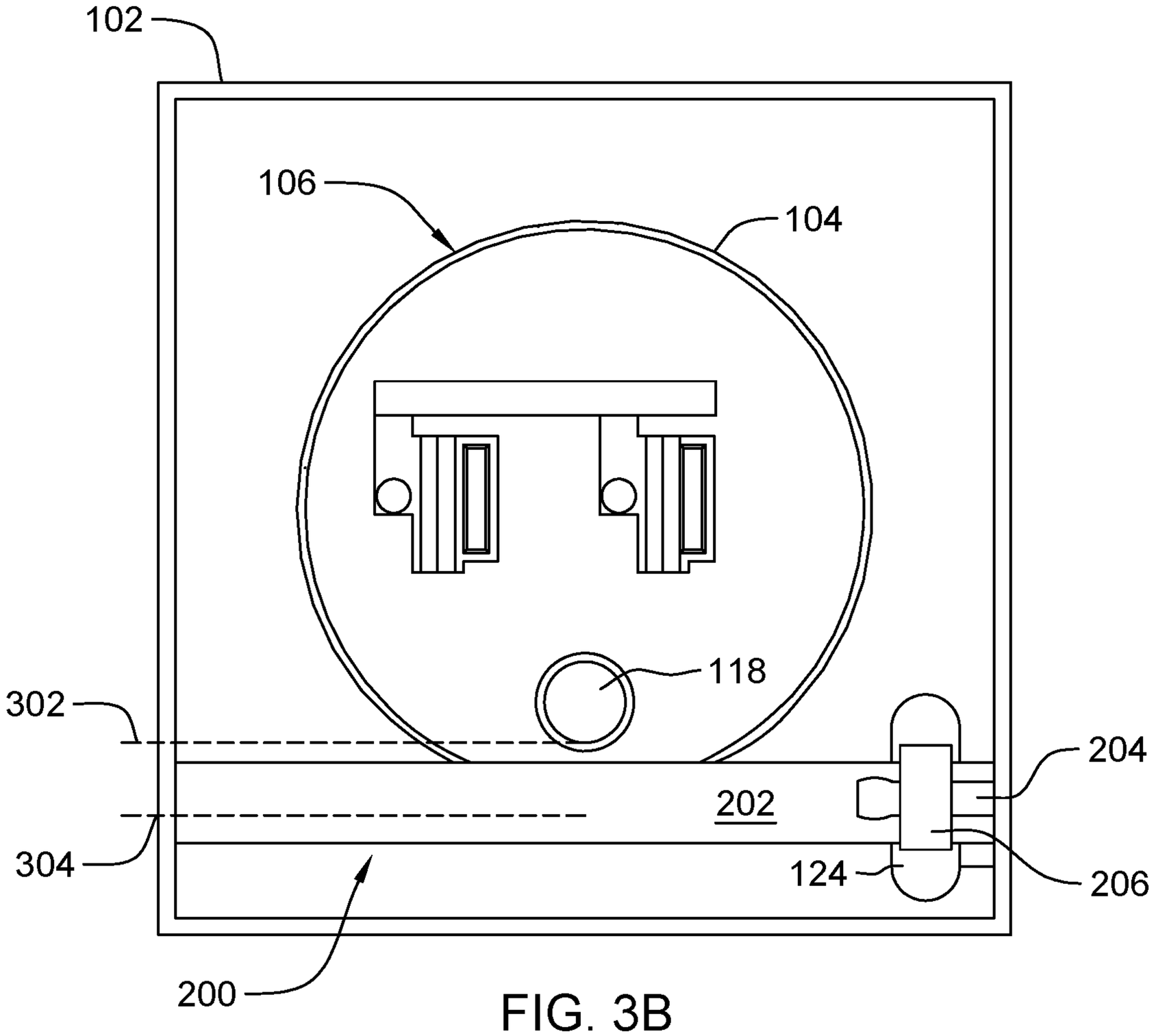

FIG. 3B

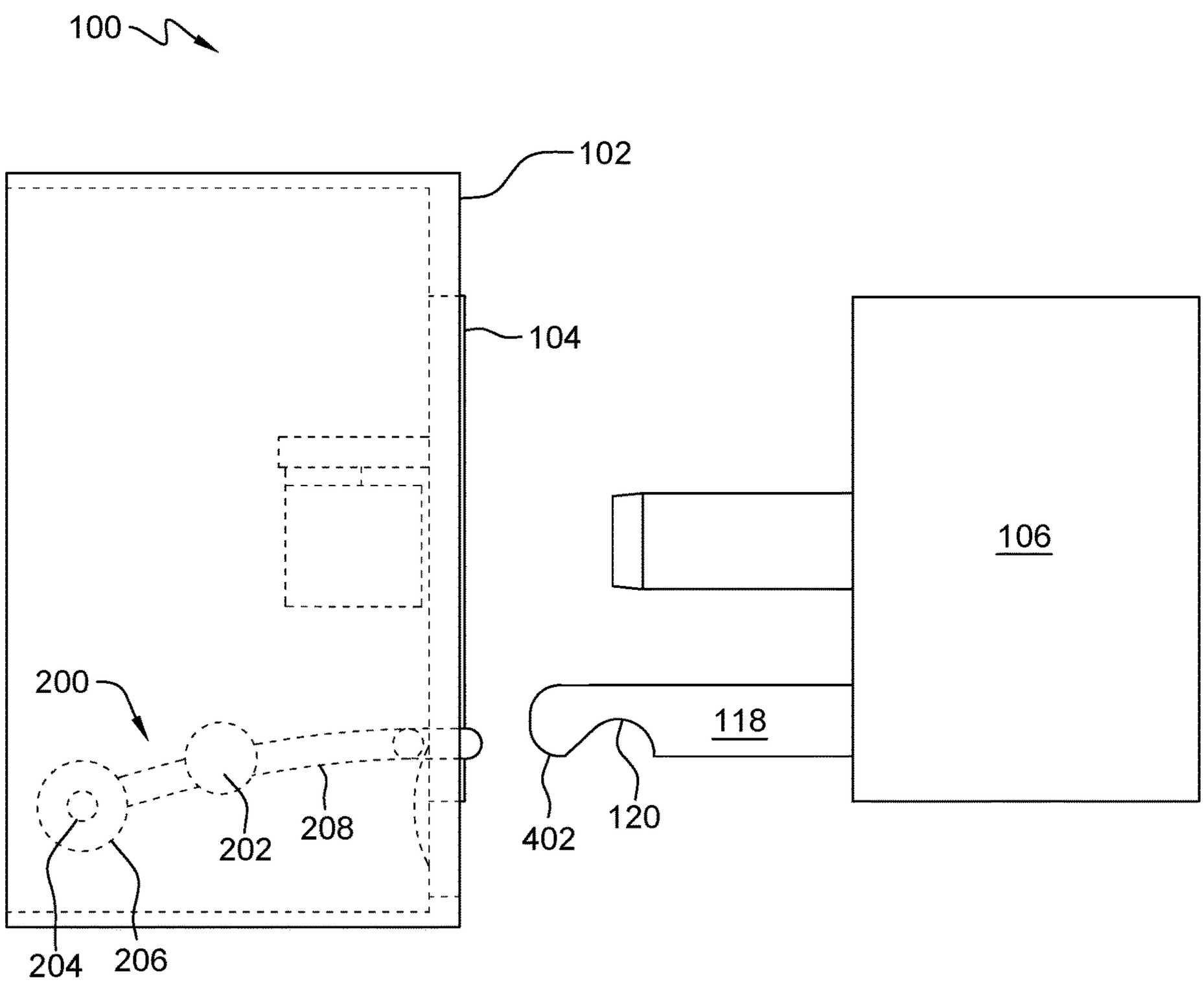

FIG. 4A

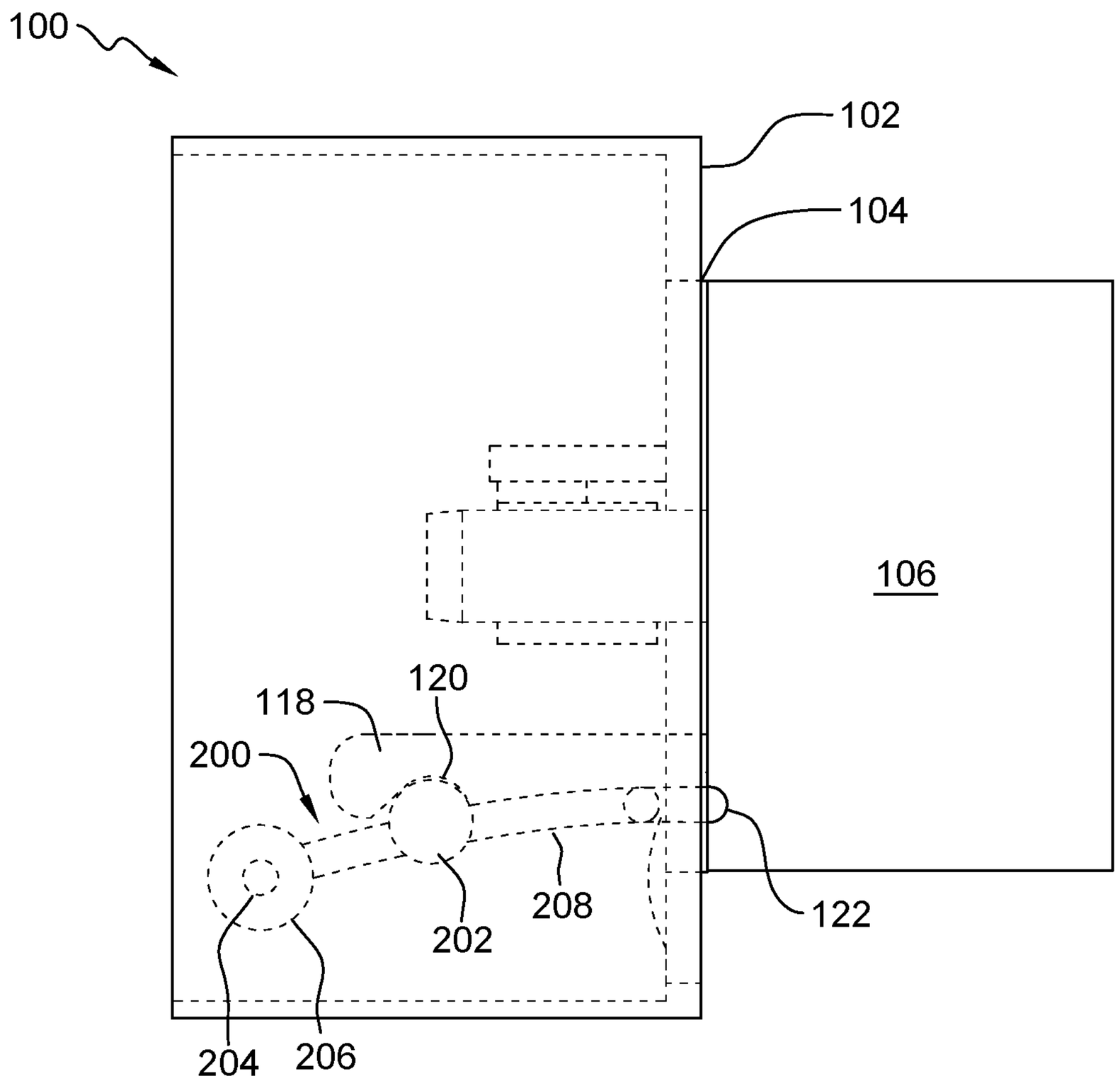

FIG. 4B

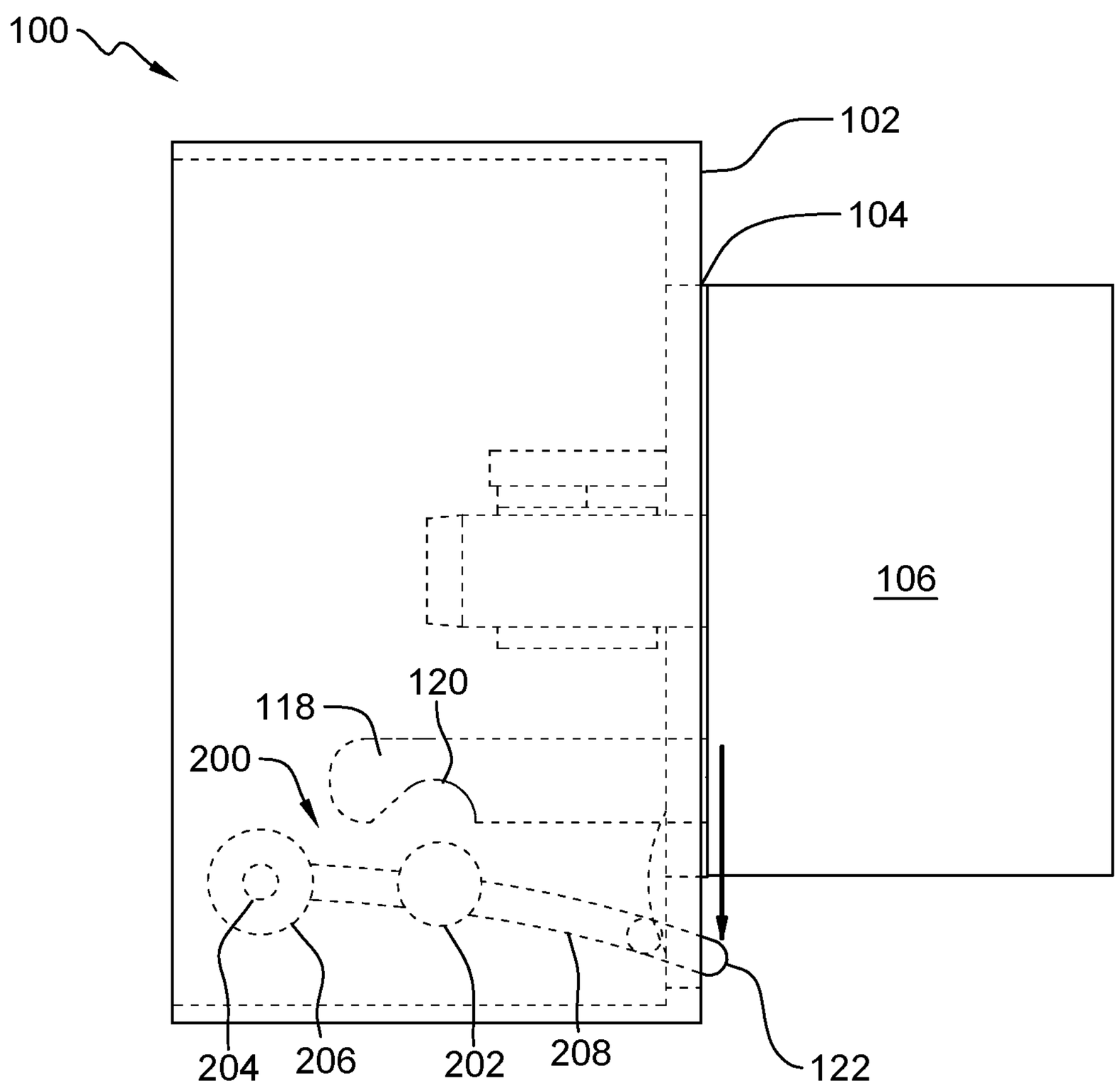

FIG. 4C

POWER OUTLET WITH RETENTION AND SHOCK PROTECTION

BACKGROUND

This disclosure relates generally to power outlet and plug combinations, and in particular, to power outlet and plug combination with integrated retention and shock protection.

Power outlet and plug combinations are widely utilized across multiple applications for providing power to various electronic devices. Loosely plugged connections between the power outlet and plug combination can damage wiring within walls due to overheating, trip a circuit breaker, or blow a fuse. A loose plug can also cause electrical arcing, where current flows through an air gap between conductors and is often a major source for electrical fires. Furthermore, pulling on a plug without positive retention can result in the plug being pulled from the socket in a manner that is damaging to the socket, the plug, and possibly to anyone in a vicinity of the plug. An NEMA 15-5 120 v AC is an example of a common 3 prong (i.e., live, neutral, ground) electrical power connection utilized for providing power to various electronic devices that can be loosely plugged into a corresponding power outlet.

SUMMARY

An aspect of an embodiment of the present invention discloses an apparatus for a power outlet and plug combination with retention and shock prevention, the apparatus comprising an electrical plug insertable into a power outlet of a receptacle, wherein the electrical plug includes a ground pin with an indent. The apparatus further comprises a retention mechanism enclosed by the receptacle includes a rod configured to interact with the indent of the ground pin, wherein the rod seated within the indent of the ground pin prevents a removal of the electrical plug from the power outlet.

Another aspect of an embodiment of the present invention discloses an apparatus for a power outlet and plug combination with retention and shock prevention, the apparatus comprising an electrical plug insertable into a power outlet, wherein the electrical plug includes a ground pin with an indent. The apparatus further comprises a retention mechanism includes a rod configured to interact with the indent of the ground pin, wherein the rod seated within the indent of the ground pin prevents a removal of the electrical plug from the power outlet.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The following detailed description, given by way of example and not intended to limit the disclosure solely thereto, will best be appreciated in conjunction with the accompanying drawings, in which:

FIG. **1**A depicts a 3-dimensional view of a power outlet and receptacle with a retention mechanism and a corresponding plug prior to insertion, in accordance with an embodiment of the present invention.

FIG. **1**B depicts a 3-dimensional view of a power outlet and receptacle with a retention mechanism and a corresponding plug subsequent to insertion, in accordance with an embodiment of the present invention.

FIG. **2** depicts a transparent 3-dimensional view of a power outlet and receptacle with a retention mechanism, in accordance with an embodiment of the present invention.

FIG. **3**A depicts a rear view of a power outlet and receptacle with a retention mechanism in a locked position, in accordance with an embodiment of the present invention.

FIG. **3**B depicts a rear view of a power outlet and receptacle with a retention mechanism in an unlocked position, in accordance with an embodiment of the present invention.

FIG. **4**A depicts a transparent side view of a power outlet and receptacle with a retention mechanism and a corresponding plug prior to insertion, in accordance with an embodiment of the present invention.

FIG. **4**B depicts a transparent side view of a power outlet and receptacle with a retention mechanism and a corresponding plug in a locked position, in accordance with an embodiment of the present invention.

FIG. **4**C depicts a transparent side view of a power outlet and receptacle with a retention mechanism and a corresponding plug in an unlocked position, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Detailed embodiments of the present invention are disclosed herein with reference to the accompanying drawings; however, it is to be understood that the disclosed embodiments are merely illustrative of potential embodiments of the invention and may take various forms. In addition, each of the examples given in connection with the various embodiments is also intended to be illustrative, and not restrictive. This description is intended to be interpreted merely as a representative basis for teaching one skilled in the art to variously employ the various aspects of the present disclosure. In the description, details of well-known features and techniques may be omitted to avoid unnecessarily obscuring the presented embodiments.

For purposes of the description hereinafter, terms such as "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom", and derivatives thereof shall relate to the disclosed structures and methods, as oriented in the drawing figures. Terms such as "above", "overlying", "atop", "on top", "positioned on" or "positioned atop" mean that a first element, such as a first structure, is present on a second element, such as a second structure, wherein intervening elements, such as an interface structure may be present between the first element and the second element. The term "direct contact" means that a first element, such as a first structure, and a second element, such as a second structure, are connected without any intermediary conducting, insulating or semiconductor layers at the interface of the two elements. The term substantially, or substantially similar, refer to instances in which the difference in length, height, or orientation convey no practical difference between the definite recitation (e.g. the phrase sans the substantially similar term), and the substantially similar variations. In one embodiment, substantial (and its derivatives) denote a difference by a generally accepted engineering or manufacturing tolerance for similar devices, up to, for example, 10% deviation in value or 10° deviation in angle.

In the interest of not obscuring the presentation of embodiments of the present invention, in the following detailed description, some processing steps or operations that are known in the art may have been combined together for presentation and for illustration purposes and in some instances may have not been described in detail. In other instances, some processing steps or operations that are known in the art may not be described at all. It should be understood that the following description is rather focused

on the distinctive features or elements of various embodiments of the present invention.

FIG. **1**A depicts a 3-dimensional view of a power outlet and receptacle with a retention mechanism and a corresponding plug prior to insertion, in accordance with an embodiment of the present invention. In the illustrated embodiment, power outlet and plug combination **100** includes receptacle **102** with power outlet **104** and plug **106**, where plug **106** is insertable into power outlet **104**. Power outlet **104** includes live aperture **108**, neutral aperture **110**, and ground aperture **112**, where plug **106** includes live pin **114**, neutral pin **116**, and ground pin **118** positioned for insertion into the respective apertures of power outlet **104**. To ensure maximum safety during insertion, plug **106** should be inserted perpendicular to a face of power outlet **104**, where live pin **114** aligns with live aperture **108**, neutral pin **116** aligns with neutral pin **116**, and ground pin **118** aligns with ground aperture **112**. Ground pin **118** of plug **106** includes indent **120** positioned on a lower portion of ground pin **118** for interacting with a retention mechanism, discussed in further detail with regards to FIG. **2**. Receptacle **102** includes release lever **122** protruding from a side shared with the face of power outlet **104** with live aperture **108**, neutral aperture **110**, and ground aperture **112**. Release lever **122** is spring loaded in a downwards direction along release guide **124**, where applying a downward on release lever **122** disengages the retention mechanism and allows for the removal of plug **106** from power outlet **104**. Release guide **124** dictates a vertical movement of release lever **122** when translating a force to the retention mechanism. Operations of release lever **122** are discussed in further detail with regards to FIGS. **4**A, **4**B and **4**C. It is to be noted that receptacle **102** with power outlet **104** can accept any traditional 3-prong plug (i.e., ground pin without an indent), where the retention mechanism does not engage with a ground pin of the 3-prong plug. However, a force applied onto the ground pin of the 3-prong plug by the retention mechanism does provide retention to a lesser extent due to a frictional interaction between the ground pin and a rod of the retention mechanism.

FIG. **1**B depicts a 3-dimensional view of a power outlet and receptacle with a retention mechanism and a corresponding plug subsequent to insertion, in accordance with an embodiment of the present invention. In the illustrated embodiment, plug **106** is inserted and seated in power outlet **104** of receptacle **102**. In addition to release lever **122** providing a means of disengaging the retention mechanism, release lever **122** is also an indicator for when plug **106** is safely seated in power outlet **104** of receptacle **102**. If plug **106** is safely seated in power outlet **104** and the retention mechanism is engaged preventing plug **106** from being inadvertently removed from power outlet **104**, release lever **122** is in a topmost position along release guide **124**. However, if plug **106** is not safely seated in power outlet **104** and the retention mechanism is not engaged allowing for plug **106** to be inadvertently removed from power outlet **104**, release lever **122** would be in any position other than the topmost position along release guide **124**. It is to be noted, though not illustrated in the Figures, plug **106** is associated with an electronic device requiring a plugged connection for power, where a second end of plug **106** includes a wired connection to the electronic device.

FIG. **2** depicts a transparent 3-dimensional view of a power outlet and receptacle with a retention mechanism, in accordance with an embodiment of the present invention. In the illustrated embodiment, retention mechanism **200** is enclosed by receptacle **102**, where retention mechanism **200** is positioned below live aperture **108**, neutral aperture **110**, and ground aperture **112** of power outlet **104**. Retention mechanism **200** includes rod **202**, pivot pin **204**, and release lever **122**, where release lever **122** includes pivot pin attachment **206**, arm **208**, and guide pin **210**. Release lever **122** of retention mechanism **200** controls a movement of rod **202**, where applying a downward force to release lever **122** unseats rod **202** from indent **120** of ground pin **118** of plug **106** (not illustrated in FIG. **2**). Retention mechanism **200** rotates about pivot pin **204** depending on whether rod **202** is seated (i.e., engaged) or unseated (i.e., disengaged) within indent **120** on ground pin **118** of plug **106**. Pivot pin **204** of retention mechanism **200** is coupled to interior surface of receptacle **102**. In this embodiment, rod **202** is perpendicularly connected to arm **208** of release lever **122** and arm **208** is connected to pivot pin attachment **206** for rotating about pivot pin **204**. In another embodiment, rod **202** is connected at an angle to arm **208** of release lever **122**, where the rod **202** can be seated and unseated within indent **120** on ground pin **118** of plug **106**.

Pivot pin attachment **206** is coupled to one end of a torsion spring and pivot pin **204** is couple to a second end of the torsion spring, where the torsion spring is biased in the clockwise direction. As pivot pin attachment **206** rotates clockwise about pivot pin **204**, the torsion spring compresses, arm **208** moves in a downward direction within receptacle **102**, and release lever **122** moves in a downward direction along release guide **124**. Guide pin **210** is positioned on either side or both sides of arm **208** and glide along an interior wall of receptacle **102** near release guide **124** to provide stability to release lever **122** when a force is applied to release lever **122** in a downward direction to disengaged retention mechanism **200** from indent **120** on ground pin **118** of plug **106**. It is to be noted, retention mechanism **200** is grounded to receptacle **102** to ensure a proper electrical ground is provided to ground pin **118** of plug **106**. Retention mechanism **200** can be implemented on a variety of conventional power outlet and plug combinations that utilize a grounding pin.

FIG. **3**A depicts a rear view of a power outlet and receptacle with a retention mechanism in a locked position, in accordance with an embodiment of the present invention. In the illustrated embodiment, plug **106** is inserted in power outlet **104** of receptacle **102**, where live pin **114** is disposed in live aperture **108**, neutral pin **116** is disposed in neutral aperture **110**, and ground pin **118** is disposed in ground aperture **112**. Retention mechanism **200** is engaged (i.e., locked position) with ground pin **118** to provide retention and shock protection between power outlet **104** and plug **106**. Arm **202** is seated within indent **120** of ground pin **118** when retention mechanism **200** is engaged to prevent plug **106** from being inadvertently removed from power outlet **104**. Engaged position line **302** represent a centerline of rod **202** of retention mechanism **200** when rod **202** is seated within indent **120** of ground pin **118**. Disengaged position line **304** represents a centerline of rod **202** of retention mechanism **200** when rod **202** is unseated from indent **120** of ground pin **118**. Disengaged position line **304** also represents a minimum downward vertical position of rod **202** to allow for the removal of plug **106** from power outlet **104**. With rod **202** at engaged position line **302**, release lever **122** (not illustrated in FIG. **3**A) is at the topmost position in release guide **124**. At engaged position line **302**, pivot pin attachment **206** can no longer rotate about pivot pin **204**, since rod **202** is seated within indent **120** and can no longer move in an upward direction.

FIG. **3**B depicts a rear view of a power outlet and receptacle with a retention mechanism in an unlocked position, in accordance with an embodiment of the present invention. In the illustrated embodiment, plug **106** is inserted in power outlet **104** of receptacle **102**, but retention mechanism **200** is disengaged (i.e., unlocked) from ground pin **118** of plug **106**. The disengaged configuration of retention mechanism **200** allows for the removal of plug **106** from power outlet **104**. The transition from engaged position line **302** to disengaged position line **304** for the centerline of rod **202**, allows for rod **202** to unseat from indent **120** of ground pin **118**. At disengaged position line **304**, rod **202** clears an interference plane adjacent to an exterior surface of ground pin **118**, where indent **120** of ground pin **118** can no longer contact rod **202** if plug **106** is removed from power outlet **104**. With rod **202** transitioning from engaged position line **302** to disengaged position line **304**, release lever **122** (not illustrated in FIG. **3**B) is transitioning downward from the topmost position to a lower position in release guide **124**. During the transition, pivot pin attachment **206** rotates about pivot pin **204** in a clockwise direction, as release lever **122** is pressed down from the topmost position to the lower position in release guide **124**.

FIG. **4**A depicts a transparent side view of a power outlet and receptacle with a retention mechanism and a corresponding plug prior to insertion, in accordance with an embodiment of the present invention. As previously discussed, power outlet and plug combination **100** includes receptacle **102** with power outlet **104** and plug **106**, where plug **106** is insertable into power outlet **104**. Plug **106** is positioned such that ground pin **118** is inserted into power outlet **104**, where rounded edge **402** of a leading end of ground pin **118** makes initial contact with rod **202** of retention mechanism **200**. As plug **106** is inserted into power outlet **104**, ground pin **118** enters receptacle and rounded edge **402** is configured to press against a top portion of rod **202**. Rounded edge **402** presses on the top portion of rod **202**, causing pivot pin attachment **206** to rotate about pivot pin **204** in a clockwise direction. Rod **202** temporarily travels in a downward direction until rod **202** reaches indent **120** of ground pin **118**, where then rod **202** travels in an upward direction into indent **120** of ground pin **118**. As previously discussed, a torsion spring positioned between pivot pin **204** and pivot pin attachment **206** allows for rod **202** to travel in the upward direction into indent **120** of ground pin **118**.

FIG. **4**B depicts a transparent side view of a power outlet and receptacle with a retention mechanism and a corresponding plug in a locked position, in accordance with an embodiment of the present invention. In the illustrated embodiment, retention mechanism **200** is engaged (i.e., locked position) with ground pin **118** to provide retention and shock protection between power outlet **104** of receptacle **102** and plug **106**, where rod **202** is seated within indent **120** of ground pin **118**. The torsion spring positioned between pivot pin **204** and pivot pin attachment **206** results in a rotation force being applied in a counterclockwise direction on pivot pin attachment **206** relative to pivot pin **204**. As a result, arm **208** with rod **202** moves in an upward direction, pressing rod **202** into indent **120** of ground pin **118**. In the illustrated embodiment, rod **202** is seated within indent **120** of ground pin **118** and can no longer travel in the upward direction. To release plug **106** from power outlet **104**, a counter force is applied to the rotational force of the torsion spring via release lever **122**. As a downward force is applied to release lever **122**, the downward force is translated to arm **208** and pivot pin attachment **206**. If the downward force is greater than the rotational force exerted by the torsion spring between pivot pin **204** and pivot pin attachment **206**, pivot pin attachment **206** rotations in the clockwise direction. As a result, arm **208** with rod **202** moves in a downward direction and becomes unseated from indent **120** of ground pin **118**. Retention mechanism **200** can also include a calculated degree of engagement force to allow for a break-away disconnection if plug **106** is forcefully pulled while rod **202** is seated within indent **120** of ground pin **118**.

FIG. **4**C depicts a transparent side view of a power outlet and receptacle with a retention mechanism and a corresponding plug in an unlocked position, in accordance with an embodiment of the present invention. In the illustrated embodiment, retention mechanism **200** is disengaged (i.e., unlocked) from ground pin **118** of plug **106**, where the disengaged configuration of retention mechanism **200** allows for the removal of plug **106** from power outlet **104** of receptacle **102**. As previously discussed, a counter force is applied to the rotational force of the torsion spring via release lever **122** to unseat rod **202** from indent **120** of ground pin **118**. As a downward force is applied to release lever **122**, the downward force is translated to arm **208** and pivot pin attachment **206**. If the downward force is greater than the rotational force exerted by the torsion spring between pivot pin **204** and pivot pin attachment **206**, pivot pin attachment **206** rotations in the clockwise direction. As a result, arm **208** with rod **202** moves in a downward direction and becomes unseated from indent **120** of ground pin **118**. Removing the downward force on release lever **122** would result in a decompression of the torsion spring rotating pivot pin attachment **206** counterclockwise about pivot pin **204** and rod **202** would move in an upward direction, pressing rod **202** back into indent **120** of ground pin **118**.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprise" (and any form of comprise, such as "comprises" and "comprising"), "have" (and any form of have, such as "has" and "having"), "include" (and any form of include, such as "includes" and "including"), and "contain" (and any form contain, such as "contains" and "containing") are open-ended linking verbs. As a result, a method or device that "comprises", "has", "includes" or "contains" one or more steps or elements possesses those one or more steps or elements, but is not limited to possessing only those one or more steps or elements. Likewise, a step of a method or an element of a device that "comprises", "has", "includes" or "contains" one or more features possesses those one or more features, but is not limited to possessing only those one or more features. Furthermore, a device or structure that is configured in a certain way is configured in at least that way, but may also be configured in ways that are not listed.

The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below, if any, are intended to include any structure, material, or act for performing the function in combination with other claimed elements as specifically claimed. The description of the present invention has been presented for purposes of illustration and description, but is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the invention. The embodiment

was chosen and described in order to best explain the principles of one or more aspects of the invention and the practical application, and to enable others of ordinary skill in the art to understand one or more aspects of the invention for various embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. An apparatus comprising:

an electrical plug insertable into a power outlet of a receptacle, wherein the electrical plug includes a ground pin with an indent;

a retention mechanism enclosed by the receptacle includes a rod configured to interact with the indent of the ground pin, wherein the rod seated within the indent of the ground pin prevents a removal of the electrical plug from the power outlet; and

a release lever of the retention mechanism for controlling a movement of the rod includes, an arm of the release lever connected to the rod and a pivot pin attachment coupled to a pivot pin of the retention mechanism, wherein the pivot pin attachment rotates about the pivot pit.

2. The apparatus of claim **1**,

wherein applying a downward force to the release lever unseats the rod from the indent of the ground pin allowing for the removal of the electrical plug from the power outlet.

3. The apparatus of claim **2**, wherein the release lever protrudes from the receptacle on a side shared with the power outlet.

4. The apparatus of claim **2**, further comprising:

a first end of a torsion spring coupled to the pivot pin attachment and a second end of the torsion spring coupled to the pivot pin.

5. The apparatus of claim **4**, wherein a clockwise rotation of the pivot pin attachment relative to the pivot pin compresses the torsion spring.

6. The apparatus of claim **5**, wherein the clockwise rotation of the pivot pin attachment translates to a downward movement of the arm and the rod, unseating the rod from the indent of the ground pin.

7. The apparatus of claim **6**, wherein a downward movement of the release lever due to the downward force translates to the downward movement of the arm and the rod.

8. The apparatus of claim **4**, wherein a counterclockwise rotation of the pivot pin attachment relative to the pivot pin decompresses the torsion spring.

9. The apparatus of claim **8**, wherein the counterclockwise rotation of the pivot pin attachment translates to an upward movement of the arm and the rod, seating the rod within the indent of the ground pin.

10. The apparatus of claim **8**, wherein the upward movement of the arm and the rod translates to an upward movement of the release lever.

11. The apparatus of claim **4**, wherein the rod is perpendicularly connected to the arm of the release lever.

12. The apparatus of claim **4**, wherein the pivot pin of the retention mechanism is coupled to an interior wall of the receptacle.

13. The apparatus of claim **4**, wherein a rounded edge of a leading end of the ground pin is configured to press against a top portion of the rod.

14. The apparatus of claim **13**, wherein pressing against the top portion of the rod results in a compression of the torsion spring and a clockwise rotation of the pivot pin attachment relative to the pivot pin.

15. The apparatus of claim **4**, wherein the release lever is positioned within a release guide on the side shared with the power outlet.

16. The apparatus of claim **15**, wherein the release guide dictates a vertical movement of the release lever.

17. The apparatus of claim **16**, further comprising:

one or more guide pins positioned on the arm configured to guide along an interior wall of the receptacle near the release guide.

18. The apparatus of claim **1**, further comprising:

a three-prong electrical plug insertable into the power outlet of the receptacle.

19. An apparatus comprising:

an electrical plug insertable into a power outlet, wherein the electrical plug includes a ground pin with an indent;

a retention mechanism includes a rod configured to interact with the indent of the ground pin, wherein the rod seated within the indent of the ground pin prevents a removal of the electrical plug from the power outlet; and

a release lever of the retention mechanism for controlling a movement of the rod includes, an arm of the release lever connected to the rod and a pivot pin attachment coupled to a pivot pin of the retention mechanism, wherein the pivot pin attachment rotates about the pivot pit.

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